No. LXIV.

An Inquiry into the comparative effects of the Opium Officinarum, extracted from the Papaver Somniferum or White Poppy of Linnæus; and of that procured from the Lactuca Sativa, or common cultivated Lettuce of the same author. By JOHN REDMAN COXE, M. D. An Honorary Member of the Philadelphia Medical Society; and a Senior Member of the Chemical Society of Philadelphia.

GENTLEMEN,

Read, Nov. 24, 1797. IN the boundleſs fields of inquiry which the book of nature opens to our view in the extenſive regions of America, much remains to be inveſtigated. Our foreſts, our fields and rivers, our mountains, and the bowels of the earth, alike invite attention from the philoſophic mind. Too long has a ſupine inactivity prevented our benefitting by the bounty of nature. She is not coy; yet ſhe requires purſuit from thoſe who wiſh to ſecure her: thoſe alone who ſeek her, will ſhe meet with a ſmile, and conduct them to the temple of honour and fortune. Proteus-like ſhe aſſumes every form, and thus ſuits herſelf to the moſt fantaſtic imaginations.

The rugged aſpect of the entrance to the various avenues of knowledge has deterred many from its purſuit, who if they had made the leaſt advance, would have perceived a ſpeedy termination to the labyrinth before them, and a luxuriant proſpect unfolding to their view, and growing more delightful in proportion as they proceeded.

Among the various objects which nature holds up to our view, none are more deſerving of inveſtigation than the *vegetable* kingdom.—Here we diſcover, plants fitted to nouriſh and to preſerve life; whilſt others ſerve, by their grateful fruits and odours to gratify the ſenſes of taſte

and ſmell; or by their brilliant colours, the eye of man. By the noble diſcovery of the art of dying, many of theſe colours have become tributary to taſte, by their tranſmiſſion to, and fixation in, other bodies; nature is thus improved upon, by rendering permanent and fixed theſe her fugacious and tranſient ornaments. In medicine, many of the moſt valuable articles of the *Materia Medica* are derived from this ſource; witneſs the ipecacuanha, jalap, rheubarb, gamboge, bark, and opium, with many others which might be mentioned, of leſs note.

Wherever we look, we find nature tributary to the labours of man. Her luxuriance is increaſed; ſhe ſeems anxious to remunerate our fatigue, and to diminiſh as far as is in her power the curſe inflicted upon the human race, in the perſons of our firſt parents, of "eating their bread with the ſweat of their brow."

Though the bounty of nature is thus variouſly extended throughout the regions of the earth, it is not the leſs our duty and intereſt, to endeavour to diſcover ſuch articles in our own country, as are ſimilar or analagous to thoſe which we obtain by importation from diſtant places; or at leaſt to draw from other countries thoſe riches which will prove equally productive, when naturaliz'd to our ſoil and climate. In the immenſe extent of the United States, may be found almoſt every climate from the torrid to the frigid zone. Let us not then deſpair of ultimately poſſeſſing among ourſelves, all thoſe invaluable ſources of health and nutrition which are drawn from the vegetable creation in every part of the globe.

The *potatoe* is not a native of our climate, nor of the European countries in which it is cultivated; yet it is one of the moſt uſeful of the vegetable tribe, and grows among us as luxuriantly as in its native ſoil of South America. The rheubarb, though not natural to the clime of Great Britain, by cultivation, has there become tributary to the wants

wants of man. Let us not then longer than is neceſſary be dependant upon foreign countries for the production of ſuch ſubſtances as our own will afford us: let us ſeek in our extenſive regions thoſe treaſures of the vegetable world, which now droop unnoticed, "and waſte their ſweetneſs in the deſert air;" and which by cultivation may become ſuch articles of commerce as amply to repay any labour expended upon them. We have too long laviſhed our treaſures upon foreign productions; let us now in turn render foreign countries tributary to us.

Having ſaid thus much, I ſhall now proceed to treat of one of the moſt valuable articles of the Materia Medica, in a curſory way, as an introduction to the ſubject of the following paper; and which I truſt from its importance will be found worthy of the attention and particular notice of your reſpectable body.

The ſubſtance I propoſe to conſider, is OPIUM; emphatically ſtyled by ſome authors, "Magnum Dei Donum," and in the claſs of ſtimulants regarded as the principal.

The plant which has *hitherto* yielded for the ſhop this invaluable drug is the *papaver ſomniferum* or *white poppy*; in the claſs polyandria and order monoginia of Linnæus. It is an annual plant; from the heads or capſules of which, the opium is obtained in Perſia, Arabia, and other warm regions of Aſia. Both the ſmell and taſte reſide in a milky juice, which is moſt copious in the cortical part of the capſules; though the leaves and ſtalks poſſeſs it in a leſs degree. This milky juice in a concrete ſtate, forms the officinal opium. *Kæmpfer* and others have long ago deſcribed the manner in which it is collected: but the moſt circumſtantial detail of the culture of the poppy, and the method employed to procure the opium from it, is that given

given by *Mr. Kerr*, as practiſed in the province of *Bahar**.

The pureſt kind of opium is chiefly retained for the uſe of the inhabitants of thoſe countries in which it is prepared; who being debarred by their religion, from wine or ardent ſpirits; accuſtom themſelves to a ſtill more pernicious luxury, by raiſing their enfeebled ideas with the ſtimulus of opium.

The quantity taken by ſome in the ſpace of twenty-four hours is truly ſurpriſing. It is true, that the uſe of it in the commencement is very moderate; but like dram-drinking becomes more neceſſary each day, to the exiſtence of thoſe who are accuſtomed to its influence.

According to Mr. Baumé *opium* conſiſts of an *extractive* matter ſoluble in water; a *reſin;* a volatile concrete oil; and a peculiar ſalt; exiſting in the following proportions.

4 ℔ of common *opium* yielded	℔.	ʒ.	ʒ.
Of *Inſoluble* matter, - -	1	1	0
Extractive matter, - -	1	15	0
Reſin, - - - -	0	12	0
Oil, - - - -	0	3	7
Saline matter, - -	0	0	1
Equal to 64 ʒ. or - -	℔. 4	0	0

In the hiſtory above referred to, of the cultivation of the poppy, previouſly to obtaining from it this invaluable drug, may be remarked the extreme labour and attention requiſite to its production. If then this time and labour can be ſaved, it muſt certainly prove beneficial to mankind, by diminiſhing the price of this uſeful remedy. Nor is

* See Woodville's Medical Botany. Vol. III. p. 505.

is there any danger that this diminiſhed price ſhould tend to increaſe the number of thoſe unfortunate wretches, who blindly ſeek to bury their faults or their misfortunes with them in the grave, by the impious and cowardly act of ſuicide. The avenues of death are too numerous, and the price of this balm to human miſery (when properly applied) is much too inconſiderable, to deter from his purpoſe a perſon, intent on terminating his exiſtence.

The *lactuca ſativa*, or common cultivated garden lettuce, is ranked by that great naturaliſt Linnæus in his claſs *ſyngeneſia*, order *polygamia equalis*, and is thus deſcribed.

"Lactuca. Receptacle naked. Calyx imbricated, cylindric, with membranous margins. Pappus ſimple, ſtiped. Seeds poliſhed."

The genus Lactuca compriſes according to Linnæus *ſeven* ſpecies; of which this is the ſecond, and is deſcribed thus, "*lactuca ſativa*, with leaves rounded on the ſtem hearted, ſtem corymbed."*

Since the time of this great man ſeveral other ſpecies have been enumerated; it is not however my intention to ſpeak of any other than the one above mentioned.

The *lettuce* had long been known to poſſeſs *narcotic* properties. None however had extracted from it a ſubſtance poſſeſſing all the properties of opium in the fulleſt degree: it was chiefly from tradition that its effects were known, and by obſerving that people were rendered ſleepy by eating old lettuce. It is the more remarkable, becauſe, as we ſhall ſee preſently, ſome have arrived at the very threſhold of the diſcovery, but have ſtopped from the purſuit.

As far back as the year 1792, and long before I had peruſed any author, upon the ſubject of lettuce, it occurred

* Syſtem of Vegetables of Linnæus, tranſlated by a Botanical Society of Litchfield. London 1783.

curred to me to try ſome few experiments, to determine the quality and nature of that milky juice which exudes from this plant in copious ſtreams when wounded; and this I was induced to do, from the well known effect of the plant in cauſing ſleepineſs when old; as well as from its peculiar ſmell and taſte.

Theſe experiments, at that time few in number, convinced me of the truth of the analogy which I had drawn between the *common officinal* opium, and the milky juice of this plant; for with a ſmall quantity of extract obtained by inſpiſſating this juice, I found ſimilar effects induced upon myſelf when taken internally in the ſame doſes with *opium* of the poppy. The moſt pleaſing ſleep was brought on by *one grain* of the extract, or by *fifteen* drops of the tincture made with proof ſpirit. By ſimilar experiments ſince tried upon myſelf in England, I found the ſame effects; and a repetition of them within a few months paſt, proves them ſtrictly the ſame. I have occaſionally removed in myſelf a ſlight cholic, with twelve or fifteen drops of the tincture: and a ſeries of comparative experiments upon frogs, &c. which I ſhall here detail, aſſure me by their uniformity of the *identity* of the *opium* extracted from the poppy and of that procured from the lettuce.

Before I proceed to relate the experiments I have made upon this ſubject, I muſt be permitted to ſhew, by quotations from ſeveral authors, how nearly they had reached the diſcovery of this fact. JONES, a celebrated author, who publiſhed in 1701 his "*Myſteries of Opium revealed*," in ſpeaking "of the election (or choice) of opium," ſays; "3. It was mixed with juice of *lactuca ſylveſtris*, or *wild endive leaved lettuce*."

"This made it of a duller *colour*, and not to ſmell ſo perfectly and rankly of the *poppy*." He ſoon after, adds, "but *lactuca ſylveſtris* being of the nature of *opium*, made the loſs of its *virtue* leſs diſcernible." See p. 13.

Dr.

Dr. CHARLES ALSTON, in the 5th vol. of the Edinburgh Medical Eſſays and Obſervations, p. 105. in his diſſertation on *opium* after mentioning ſeveral articles with which it is reported to be adulterated, adds, " I know not the *glaucium* of the ancients, nor did I ever ſee any *opium* that I had reaſon to ſuſpect as adulterated with *gum* or *ſuet*; but the *wild lettuce*, that is, the *lactuca ſylveſtris, odore viroſo*, C. B. Pin. 123. abounds *more than any poppy* I know, with a milk of the ſame taſte and ſmell; perhaps therefore this, if it can be more eaſily collected, may ſtill in ſome places be mixed with *opium*, and the medicine be nothing the worſe for it, the milk of even the *common lettuce* being anodyne and ſomniferous, as well as that of the poppies."

See alſo his 57th. lecture in the 2d vol. of his Materia Medica, p. 153. et ſeq.

HILL in his *Britiſh Herbal*, p. 436, under the head of *lactuca*, has the following: " Diviſion I. 1. *Great wild lettuce. Lactuca ſylveſtris major opii odore.*"

" The root is long, thick and whitiſh; and when cut, it yields abundantly a yellow juice, of a very unpleaſant ſmell, reſembling that of opium; and of a bitter, nauſeous taſte." " C. Bauhine calls it, *lactuca ſylveſtris odore viroſo.* Others, *lactuca ſylveſtris major odore opii.*"

" This is one of thoſe Engliſh plants which deſerves to be more known in medicine. It has been called poiſonous, and men have from that been frighted from its uſe; but it is a very *gentle* and a *ſafe opiate.* The beſt way of giving it is in a ſyrup made from a decoction of the freſh leaves and ſtalk. This way it greatly exceeds the common diacodium, and may be given to tender conſtitutions with more ſafety. This I write from experience."

DALE has deſcribed the *lettuce* alſo in his Pharmacologia, p. 80. In this the different characteriſtic names of various authors are brought together. *J. Bauhine* calls it " *lactuca ſylveſtris lato folio, ſucco viroſo.*" I. B. ii. 1002. DIOS-

CORIDES has ſaid, according to *Dale*, that it mitigates pain.

DALE has alſo made a ſecond ſpecies or variety of the *lactuca ſylveſtris*, under the diſtinguiſhing mark of, "*L. ſylv. coſta ſpinoſa*, or *jagged leav'd wild lettuce.*" I ſhall here quote his own words.

"Lactuca ſylveſtris ſativæ ſimilis eſt (ut ſcribit Dioſcorides) ſed longior caulis, et folia gracioliora, et aſperiora; maro guſtu eſt. Quæ de viribus lactucæ ſylveſtris veteres prodiderunt, quod ſcilicet ſemen ejus non minus quam ſativæ libidinum imaginationes in ſomno amolitur, et venerem arcet; cui huic plantæ conveniant, dubitat *D. Raius.* Narcoticam eam eſſe et ſoporiferam, adeoque (ut rectè obſervat) *viribus papaveri ſimilem*, ut *Dioſcorides* et *Plinius* tradunt, *opii vehemens et viroſus odor abunde convincit*," et ſeq.

Theſe quotations will ſuffice to prove, that however analagous their authors might ſuſpect the *officinal opium* and the juice of the lettuce to be; they had not put it to the teſt of experiment. I now proceed to ſtate thoſe which I have made.

LETTUCE OPIUM.	COMMON OPIUM.
Experiment 1.	*Experiment* 2.
July 1ſt. 1797. To one ounce of rain water, I added 5 grs. of the *opium* of the lettuce in the vial marked, A.	The ſame day I added a ſimilar quantity of rain water to 5 grs. of the *opium* of the poppy, in the vial marked, B.

I frequently agitated both vials, and on the 21ſt of the month, I found by filtration, only one grain and a half, left on the filtre of the vial A. whilſt 2 grains were left on that of B.

This difference of half a grain I at firſt aſcribed to the common opium being much more dry than that of the lettuce which was freſhly made; and hence, in an equal weight not containing ſo great a proportion of fixed matter.

The colour of the ſolution A. was however much deeper than that of B. and ſucceeding experiments convinced me that the quantity of *extractive* matter in the *lettuce opium*, is conſiderably greater than in the common. By the aid of my ingenious and worthy friend Dr. *Cooper*, of this city, I obtained a larger quantity of the *lettuce* opium, with which I was enabled to make the following.

LETTUCE OPIUM.

Experiment 3.

Auguſt 14th. I put 20 grains of *this opium* thoroughly dried, into *two* ounces of filtered rain water, in the vial A. and after repeated agitations, I filtered it on the 18th. When dried, there were left on the filtre, 10 grains, ſo that *one half*, was pretty accurately held in ſolution. The filtered ſolution was of a dark brown colour, poſſeſſing much of the taſte and ſmell of *opium*.

COMMON OPIUM.

Experiment 4.

Auguſt 19th. I put 20 grains of *common* opium into a ſimilar quantity of rain water in the vial B. On the 24th, I filtered it after frequent agitations. There remained on the filtre, when dried, grains 11, which conſequently leaves but 9 twentieths, diſſolved by the water. The filtered ſolution was not nearly of ſo deep a colour, as that of A.

To both of theſe ſolutions I added about a drachm of alkohol, to prevent putrefaction.

LETTUCE OPIUM.

Experiment 5.

Auguſt 19th. I put the 10 grains remaining on the filtre of A. (experiment 3.) into an half ounce of alkohol. I filtered it on the 29th, and found 7 grains left on the filtre, which when waſhed and dried, was devoid of taſte or ſmell. The quantity of *reſinous* matter then was 3 grains, or rather more than one 7th of the whole maſs.

COMMON OPIUM.

Experiment 6.

Auguſt 26th. I put the 11 grains remaining on the filtre of B. (experiment 4.) into the ſame quantity of alkohol. I filtered it on the 29th, and found 8 grains left on the filtre; devoid of taſte and ſmell, when waſhed and dried. Here then the proportions agree.

The colour of *this* ſolution in alkohol was much deeper than that of experiment 5.

Neither of the above ſolutions poſſeſſed to any conſiderable degree the peculiar ſmell or taſte of *opium*; probably from the large proportion of alkohol. The *reſin* was precipitated from the ſolutions in alkohol, by the addition of water. That of the lettuce appeared to me *whiter* than the other; but not ſo copious: the opium taſte, &c. was more evident in the water. Its reſin was more evident by ſtanding ſome days.

LETTUCE OPIUM.

Experiment 7.

Auguſt 19th. I put 20 grains of the *lettuce* opium into the vial A. and added to it one ounce of a mixture of equal parts of alkohol and rain water. On the 29th, after repeated agitation I filtered it and found that $12\frac{1}{2}$ grains had been taken up, as $7\frac{1}{2}$ remained on the filtre after waſhing and drying. The ſolution eminently poſſeſſed the ſmell and taſte of laudanum; and was of an higher colour than that of the following experiment.

COMMON OPIUM.

Experiment 8.

The ſame day, I put a ſimilar quantity of *common* opium into the vial B. and added the ſame quantity of the mixture of the alkohol and water. By filtration on the 29th, *ſeven* grains were left upon the filtre; or 13 grains were ſuſpended in the ſolution.

This difference I regard as proceeding from a ſmall allowance not being made in the weight of the *opium* of the *lettuce*, which had not dried thoroughly; and hence not containing as much *ſolid* matter in the whole maſs.

The maſs left on the filtre A. was of a more *gummy* feel than that of B. and not of ſo high a colour; the ſmell or taſte of opium was not very evident in either of them.

With the ſolutions of experiments 3 and 4, I proceeded now to make the following.

LETTUCE OPIUM.

Experiment 9.

To a ſolution of ſugar of lead, I added 30 drops of the aqueous ſolution of the *opium lactucæ*; a copious brown coloured precipitate inſtantly formed. The *opium* ſmell was evident.

COMMON OPIUM.

Experiment 10.

A ſimilar effect took place with the acetite of lead, and the aqueous ſolution of common opium. The precipitate was not as dark as the former; the *opium* ſmell was evident.

Experiment

LETTUCE OPIUM.

Experiment 11.

To a ſolution of ſulphate of iron (green vitriol) I added 20 drops of the aqueous ſolution. A browniſh coloured precipitate was formed; but not very copious. The ſupernatant liquor upon the ſubſidence of the precipitate was of a *dirty green*; as was alſo the precipitate itſelf upon ſtanding. The *opium* ſmell was retained.

Experiment 13.

To a ſolution of *hepar arſenicum* (made with orpiment and quicklime) I added 20 drops of the above aqueous ſolution; a *brown* and pretty copious precipitate was here formed. The ſupernatant liquor appeared clear. The hepatic ſmell ſeemed to be augmented by the union of the two ſolutions.

Experiment 15.

To one drachm of *lime-water*, I added 20 drops; a browniſh precipitate was formed. The opium ſmell remained.

Experiment 17.

I added 20 drops, to 15 drops of *nitrate of ſilver*, diluted with rain water; a light coloured cloud gradually formed itſelf after ſtanding ſome time.

Experiment 19.

I added 20 drops to a ſolution of *carbonate of ammonia*; a browniſh coloured precipitate took place. The peculiar ſmell of both ſolutions, was evident.

COMMON OPIUM.

Experiment. 12.

The precipitate here was of a darker colour, but in the ſame proportion apparently. The ſolution was itſelf of a *brown* colour, and retained the *opium* ſmell.

Experiment 14.

The precipitate here, was of a light *green* colour, and very ſmall in quantity, until after ſtanding a conſiderable time, when the cloud began to ſubſide of a browniſh or dirty green colour. The hepatic ſmell ſeemed increaſed.

Experiment 16.

In this experiment, a browniſh precipitate was likewiſe formed, though leſs abundant; the opium ſmell remained.

Experiment 18.

The ſame effect, but in a leſs degree, took place in this experiment.

Experiment 20.

In this experiment the ſame effects took place.

LETTUCE

LETTUCE OPIUM.

Experiment 21.

I added 20 drops to a diluted ſolution of *nitrat of copper*. The green colour of the latter, predominated; but a very lightiſh brown coloured precipitate gradually ſubſided.

COMMON OPIUM.

Experiment 22.

In this experiment the brown colour of the ſolution of opium predominated, and a beautiful clear ſolution remained which did not become cloudy after ſtanding 10 minutes.

Experiment 23.

A copious lightiſh brown coloured precipitate was produced by adding 20 drops, to a diluted ſolution of *nitrat of mercury*.

Experiment 24.

A ſimilar effect took place in this experiment.

Experiment 25.

Alkohol, diluted with water, produced no effect when added to the above ſolution.

Experiment 26.

This experiment proved the ſame.

As in the above related experiments, the general effects of the *two ſpecies* of opium were pretty nearly ſimilar, with *chemical* teſts; I thought a ſet of *comparative* experiments made upon frogs, would be proper to illuſtrate ſtill farther this identity. I therefore ſubmitted ſeveral to the action of the *opium* in the manner following.

Experiment 27.

July 1ſt. In a vial (C.) I put 8 grains of the *opium lactucæ*, and added by meaſure half an ounce of good brandy. On the 14th of Auguſt, I filtered it, and found 2 grains left upon the filtre. This I put into the ſame vial C. and added half an ounce of filtered rain water. The maſs was of a *gummy* nature, poſſeſſing nothing of the peculiar *taſte* of opium, and but little of the *ſmell*. On the 16th, after filtering it, I ſtill found 2 grains remaining. The water had acquired

acquired an evident bitter taſte, and a ſlight ſmell; which was doubtleſs owing to my neglect of *waſhing* the maſs previouſly to the addition of the water.

EXPERIMENT 28.

Auguſt 20th. At 12 o'clock, I injected a portion of this *aqueous* ſolution (experiment 27.) between the ſkin and muſcles of the *right* lower extremity, of a fine lively bulfrog. At the ſame time I alſo injected between the muſcles and the ſkin of the *left* lower extremity, a mixture of *one* part of alkohol, and *two* of water. He did not appear ſenſible of pain at the introduction of either, but leaped about in the receiver, in which I confined him, with great vigor. At 10 minutes after 12, he appeared equally vigorous; as he did at the expiration of 15. I now injected ſome more of the ſame ſolution under the ſkin of the *right* extremity, but found no alteration evinced at the end of 10 minutes. I therefore introduced a third portion, at the diſtance of 25 minutes from the firſt; but without any alteration, excepting a ſlight convulſion, in drawing the leg to the body, and which probably was occaſioned by the irritation of the inſtrument uſed in injecting the ſolution. Finding no effect produced by the ſolution upon the muſcles of the extremities, I injected a portion into the *ſtomach* at 30 minutes after 12. At 35 minutes after 12, the *right* leg was moved with conſiderable difficulty; and generally remained in an *extended* poſition, unleſs ſtruck or otherwiſe irritated; when it was drawn forwards pretty forcibly. The frog could uſe it very well in the action of jumping; and he did not ſeem affected by what was taken into the ſtomach, except that reſpiration appeared to be increaſed at the end of 10 minutes.

A portion injected into the *rectum*, produced no effect; and his legs had regained their perfect uſe.

At

At 10 minutes before one o'clock, I introduced between the ſkin and muſcles of the *left* leg (which had had the alkohol and water injected into it at the commencement of the experiment) a portion of the *aqueous ſolution* of the *opium lactucæ*, of the vial A. (experiment 3.) At this time the frog was very lively. Much of the ſolution was diſcharged by the motion of the leg in placing him under a receiver: in 5 minutes he moved about briſkly; in 10 his *left* leg began to drag. At this period of the experiment, ſomething occurred to carry me away, and I put the frog into the water.

Experiment 29.

Auguſt 21ſt. The frog, the ſubject of the preceding experiment, had perfectly regained his livelineſs and animation. At 30 minutes after one o'clock, I injected a few drops of the *aqueous* ſolution A. (experiment 3.) into his ſtomach. In 3 minutes, conſiderable contractions of his abdomen appeared, and continued at intervals; with an opening of the fauces, as if to obviate the difficulty of reſpiration. By agitating him, he was made to move with conſiderable briſkneſs. At 15 minutes before 2, he appeared very lively. I injected a ſecond portion into his ſtomach, and a third, at 20 minutes after 2, as he ſtill continued very lively. Neither of theſe appeared to affect him. At 25 minutes after 3, I injected a portion, through a ſmall inciſion, into the abdomen; a conſiderable part of it was rejected; but his lower limbs were paralized to a certain degree in 5 minutes. He could not jump, but drew his legs after him with much difficulty. In 12 minutes he could jump ſlightly. At 45 minutes after 3, I injected more, and retained it by keeping him upon his back. At 4 o'clock he jumped pretty well. At 30 minutes paſt 4, he continued lively. I now put him into the water, but found him *dead* the following day.

His

His death aroſe, in all probability from *inflammation*, induced in the abdomen, by the inciſion made into it for the introduction of the ſolution; at leaſt it muſt have had ſome influence.

Experiment 30.

Neither the *aqueous ſolution* A. (experiment 3.) nor *alkohol* and *water*, appeared to affect this frog when dropped upon the naked eye.

Experiment 31.

Several drops of the *aqueous ſolution* A. (experiment 3.) were dropped into my *right* eye. It gave me ſome degree of pain, which was not of long duration. I felt no other inconvenience from it; but a ſlight inflammation for ſome hours was evident in it.

Experiment 32.

After ſeparating by inflation the ſkin and muſcles of the *right* inferior extremity of a fine active frog; I injected, at 20 minutes before 4, ſeveral drops of the *aqueous ſolution* of *opium lactucæ*, A. (experiment 3.) In 5 minutes little effect was induced. In 10 he experienced ſome difficulty in moving it, and it was accompanied with a dragging motion. In 15 minutes ſtill greater difficulty. Upon extending the leg it was retained in that poſition; whilſt the *left* was quickly drawn up to the body; yet when the *right* leg was irritated, it was exerted with conſiderable facility.

In 20 minutes the ſenſe of feeling ſeemed to be in ſome degree impeded; for it did not appear to evince by any contractions, that it felt pain from a pointed inſtrument in this leg, though in the *left*, it was very evident.

At 5 minutes paſt 4, I introduced ſome of the ſame ſolution beneath the ſkin of the *left* leg. At 10 minutes paſt 4 there was conſiderable difficulty in moving this leg; and his motion ſeemed now to be performed by puſhing himſelf on with his fore-legs. If he wiſhed to jump, he was compelled to puſh his body back upon his hind legs, inſtead of drawing them up to his body. The jump was only the length of his hind legs, which then remained extended as before. A ſilver probe introduced into the opening made to inject the ſolution, produced convulſions in both legs, by the aid of zinc. At 15 minutes after 4, both his legs appeared perfectly paralytic. At 20 minutes after 4, I injected ſome of the ſame ſolution under the ſkin of the abdomen, which ſeemed in ſome degree, after a ſhort time to paralize his fore-legs.

The ſolution applied to the naked eye of the frog did not ſeem to affect it in the leaſt, as it did not cauſe it to cover it with the lids.

At 30 minutes after 4, I injected ſome drops into the ſtomach, which ſeemed at firſt to convulſe it conſiderably; It appeared to ſtrive to vomit, opening its mouth to the utmoſt extent, and making repeated convulſive motions of the œſophagus. It could not now move its lower limbs, though they were occaſionally convulſed; and violent convulſions were induced by zinc and ſilver.

At 20 minutes before 5, it ſeemed to have expired, but by introducing a few more drops into the ſtomach, a ſlight convulſion was induced in about a minute. At 15 minutes before 5, it was completely dead.

Ten minutes before 5, I opened the thorax and abdomen. The heart beat 80 pretty vigorous pulſations in a minute. After removing the pericardium, I put a drop of the ſolution upon the heart, which did not appear to diminiſh its frequency. I now removed it from the thorax, and put it into ſome drops of the ſolution, which ſeemed ſoon to check it,

it, for at 5 o'clock it beat only 50 weak pulſations in a minute, and at 10 minutes paſt 5, only 18, and chiefly of the auricle. A pointed inſtrument ſcarcely increaſed its vigour.

The ſtomach was corrugated, and contained the ſolution mixed with a ſlimy matter.

EXPERIMENT 33.

At 15 minutes before 2, P. M. I injected a few drops of the aqueous ſolution A. into the abdomen of a lively frog, the greateſt part of which eſcaped. Though the frog was *ſtifly* contracted before the introduction of the ſolution; yet the abdominal muſcles relaxed and elongated themſelves the inſtant it was introduced.

At the expiration of 5 minutes no effect was produced. At 10 minutes being equally lively, I introduced another portion and retained it there for ſome time.

In 10 minutes he *lay* upon his abdomen, not as uſual reſting upon his legs. Irritation with a pointed inſtrument, did not now cauſe his extremities to contract; they appeared perfectly paralized. When placed upon his back, he lay without motion. His eyes were ſenſible to irritation.

In 20 minutes he began ſlowly to move his lower, and ſoon after his upper extremities, and gradually elevated himſelf upon them as uſual. Contractions were produced by zinc and a ſilver probe paſſed into the abdomen.

In 5 minutes from this time he appeared to be nearly dead, and was completely ſo in two or three minutes longer. At 3 o'clock his limbs were nearly ſtiff.

On opening the thorax the heart was beating 60 vigorous pulſations in a minute. I removed it from the body, and in 15 minutes it pulſated only 32, and chiefly of the *auricle*. In 30 minutes after 3, it beat only 10 times. At 45 minutes, it was excited to a few weak pulſations by a pointed inſtrument.

The length of time in which contractions may be induced by metallic ſubſtances, in the frog, is much diminiſhed by the application of opium. In 20 minutes after the death of this frog I could not produce any; now they may be induced at the expiration of 48, 72 and even a greater number of hours, in a frog killed by cutting off, or cruſhing the head; as the experiments of Dr. Fowler on animal electricity evince.

EXPERIMENT 34.

Auguſt 22d. At 10 minutes after 3 o'clock, I expoſed to view the *brain* of a frog, and put a few drops of the aqueous ſolution A. upon it. By a want of attention to the motions of the frog, the greateſt portion of it was ſpeedily loſt. In 5 minutes he was very lively. In 10 minutes the ſame. At 30 minutes after 3, I introduced a ſecond portion with greater care, which almoſt inſtantly ſeemed to affect him; for inſtead of ſupporting himſelf as uſual upon his legs, he lay upon his abdomen. In 5 minutes his *left* leg ſeemed paralized, and he tumbled about with a ſort of convulſive motion. In 10 minutes he was more affected. A pointed inſtrument ſcarcely cauſing him to move; and his motions were chiefly confined to his *upper* extremities.

In 20 minutes he appeared to be quite dead. On opening the thorax I found the heart pulſating vigorouſly 56 times in a minute. In 15 minutes from this time it beat 48. In this frog, the contractions produced by zinc and ſilver were by no means ſo vigorous, as in thoſe killed without the application of opium.

EXPERIMENT 35.

By way of a comparative experiment, on the 26th of Auguſt, I injected ſome drops of the aqueous ſolution of *common.*

mon opium, B. (experiment 4.) beneath the ſkin of the *right* inferior extremity of a lively frog, at 15 minutes before 1 o'clock. At 1, he was quite lively. By means of a probe, I now detached the ligamentary union of the ſkin at the knee, and paſſed a ſecond portion of the ſolution down to the ankle joint. In 20 minutes he was as lively as ever. I now injected a third portion and retained it ſome time. A *prolapſus ani* occurred during the introduction of the ſolution by the ſole exertion of the animal, as no force was employed. In 5 minutes his leg began to drag, and in 10 minutes he could not move it. The *left* was uſed with violence when irritated.

At 20 minutes before 2, I injected a portion into the ſtomach, which almoſt inſtantly convulſed him, in a manner reſembling the contractions produced by zinc and ſilver. His *irritability* was ſo highly increaſed from the effects of the opium, that the ſlighteſt touch produced convulſions in all his extremities. After ſome minutes more had elapſed, a ſudden noiſe or even blowing upon him, would produce them, and they became more frequent by degrees. At 2 o'clock they were leſs conſiderable, and at 10 minutes paſt 2, he appeared dead, as irritation produced no contractions.

On opening the thorax, the heart beat 48 vigorous pulſations in a minute. The ſtomach was filled with a ſlimy maſs, poſſeſſing the ſmell of opium, and it appeared to have contracted upon itſelf about the middle. The veſſels on its ſurface were diſtended with blood. Contractions induced by zinc and ſilver, were very inconſiderable; being confined chiefly to the toes of the *right* leg, even when the ſilver was placed in contact with the large ſciatic nerves; and in the *left* leg, ſimilar contractions extended no farther than the foot. At 3 o'clock *neither* would contract. The *auricle* was ſtill pulſating 27 times in a minute.

Having ſhewn by the preceding experiments that there exiſts a great ſimilarity between the effects of the aqueous ſolutions

ſolutions of *common*, and of the *lettuce* opium; I next proceeded to ſome few experiments with the *ſpirituous tinctures*, A. and B. deſcribed in experiments 7 and 8.

EXPERIMENT 36.

September 2d. At one o'clock, P. M. I injected between the ſkin and muſcles of the *right* inferior extremity of a lively frog, a few drops of the ſpirituous tincture of *opium lactucæ*, A. (experiment 7,) and at the ſame time, I introduced beneath the ſkin of the *left* leg ſome of the ſpirituous tincture of *common opium*, B. (experiment 8.) At the moment of introduction both tinctures gave pain, and by the efforts which the frog made to eſcape, a conſiderable portion of the tinctures was loſt. In 5 minutes he hopped with great difficulty; or rather, his motions ſeemed to be performed by quickly and repeatedly puſhing himſelf on by his lower extremities. Conſiderable inflammation was ſpeedily induced in both thighs, and blood was even effuſed.

In 10 minutes his motions were more difficult; and his jumps more circumſcribed. Both legs ſeemed equally affected.

A drop of the tincture put upon his eye appeared to give pain, as he immediately cloſed it.

In 20 minutes I injected a few more drops below the ſkin of the inferior extremities. In a few minutes, both legs appeared immoveable. In 5 minutes from this time, the inflammation was ſeen extending itſelf with conſiderable ſpeed, down the legs; as many ſmall veſſels before inviſible to the naked eye, were now diſtended with red blood. His legs lay motionleſs in any poſition they were placed; and no irritation, except that produced by zinc and ſilver, cauſed them to move. Theſe metals cauſed ſtrong convulſions in both.

For

For nearly 20 minutes he ſeemed to be dead. After which a very ſlight touch convulſed him; and by this time the inflammation had extended to his toes.

Some buſineſs carried me away at this period. I did not return till nearly 3 o'clock, when I found the frog laying as I left him; but the irritability of his ſyſtem was ſo highly increaſed, that a very ſlight touch cauſed ſtrong convulſive motions. I now placed him in a tumbler of water, and at 20 minutes after 3, the merely making a noiſe, as in the motion of a chair along the floor, and even only touching the glaſs in which I had placed him, cauſed ſuch ſtrong convulſions, as nearly to project him from it. By degrees this effect ceaſed; and by 4 o'clock he was quite dead.

On opening the thorax the heart was beating 45 moderate pulſations in a minute. The *right* leg exhibited ſtronger marks of inflammation than the *left*; as the veſſels were more turgid, and one or two conſiderable effuſions had taken place into the ſubſtance of the muſcles,

EXPERIMENT 37.

Fifteen minutes before two o'clock, I introduced a few drops of the ſpirituous tincture, A. (experiment 7.) into the ſtomach of a fine lively bulfrog. A violent and inſtantaneous projection of the tongue ſhewed a diſpoſition to vomit it up. He jumped about under the receiver with great vigor. In 10 minutes he began to breathe more quickly, and his jumps appeared more languid. When placed upon the ground, he could not jump above twice or thrice his length. About 3 o'clock he appeared to have recovered conſiderably from the effects of the tincture.

At 10 minutes paſt 3, I injected a few drops below the ſkin of the *right* lower leg, which cauſed conſiderable pain. A portion of it was loſt, and a ſlight effuſion of blood took place, which probably waſhed away another portion of the tincture

tincture. At 20 minutes paſt 3, he moved with conſiderable agility, and ſeemed very briſk. In 30 minutes he appeared quite well. I now injected a ſecond portion under the ſkin of the leg. At 35 minutes after 3, he moved it very briſkly. At 40 minutes after, the *right* leg began to drag, although he could draw it to his body; and he lay with his head upon the table, inſtead of ſupporting himſelf upon his legs as uſual. I now put him into ſome water, which revived him conſiderably; ſo that at 4 o'clock he moved his legs with eaſe, and by 20 minutes after, he uſed them vigorouſly; though ſtill he was unable to leap to any diſtance.

At 20 minutes before 5, I introduced ſome more of the tincture into the ſtomach. In 10 minutes, he appeared very languid. Five minutes before 5, his legs remained motionleſs in any poſition in which they were placed, and were inſenſible to irritation. At length he gradually began to mend, and at 6 o'clock could move his limbs with great eaſe. I now put him into the water, and the next day found him quite lively.

EXPERIMENT 38.

September 5th. At one o'clock, P. M. I laid bare the brain of the frog, the ſubject of the preceding experiment. He had perfectly recovered from the effects of that experiment, and was extremely lively. I injected ſome drops of the ſpirituous tincture A. down the ſpinal canal, which ſeemed inſtantly to affect him, as his fore legs were conſiderably paralized. He appeared ſomewhat recovered in 10 minutes, but breathed quick. The greateſt part of the tincture was diſcharged and waſhed away by ſome blood which oozed from the wound. At 15 minutes after one, with more care, I introduced a ſecond portion, which paſſed to all appearance, lower than the firſt. In a moment the *whole* muſcular

muſcular fabric, became motionleſs and relaxed. The eyes cloſed; reſpiration ceaſed; and a ſlight pulſation of the heart, evinced by the motion of the thorax, alone rendered it probable that any vitality remained. No contractions of the extremities followed the application of a pointed inſtrument; but zinc and ſilver cauſed ſtrong convulſive motions of the limbs. If the brain was touched with a ſilver probe, and brought into contact with the zinc on which the frog was placed, ſtrong contractions of the body and limbs ſucceeded. When the probe was introduced to ſome diſtance down the ſpinal canal, the frog moved. At 25 minutes paſt one, he opened his eyes; and drew up ſoon after, his extended *lower* extremities to his body. At times the muſcles of his *upper* limbs appeared ſtrongly contracted, and they generally remained in the ſame poſition unleſs irritated.

At half paſt one, he ſuddenly became moſt violently convulſed; writhing his body and limbs, in every poſſible direction; and he even threw himſelf with conſiderable force from the table on which he was placed, although *at leaſt ſix inches* from its edge. During the period of theſe violent convulſions he uttered a croaking noiſe. The convulſions were induced by the ſlighteſt noiſe, extending even to the toes; and they were more evident in proportion to the *ſuddenneſs* of the cauſe producing them. In 5 minutes this effect diminiſhed conſiderably, and his limbs when extended were ſlowly drawn up again to the body.

At 20 minutes before 2, I left him feebly ſupporting himſelf upon his legs; and did not return till about 5 minutes before 3, when I found him under the receiver, and lying upon his back, as if from a renewal of the preceding convulſions. His eyes were open, and he moved ſlightly when touched. A probe paſſed down the ſpine cauſed his extremities to move. In 10 minutes from this time, very little effect was produced by paſſing the probe down the

ſpina canal; and in a minute or two, he appeared completely dead.

Convulſions produced by zinc and ſilver were ſtill ſtrong. The heart on expoſing it to view was pulſating moderately 42 times in a minute.

EXPERIMENT 39.

At 30 minutes paſt 4, I injected a few drops of the above tincture A. into the ſtomach of a young frog; which cauſed it to *gag*, and a conſiderable portion was rejected. In 5 minutes he remained under the receiver pretty quiet; though before this he had been ſtriving violently to eſcape. When touched he did not jump, but lay in the poſition in which he was placed. Ten minutes before 5 o'clock, his reſpiration was quick, being 66 times in a minute. His hind legs were moved with difficulty, and he lay with his head upon the table.

At 5 minutes paſt 5 he began to move about, and ſeemed to have recovered conſiderably. Buſineſs now calling me away, I put him into the water. At 10 o'clock he was very active and vigorous, and continued ſo till I threw him out ſome days after.

The following very intereſting experiments, were made at my requeſt at the Pennſylvania Hoſpital by my very ingenious and worthy friend Dr. Samuel Cooper, to whoſe kindneſs I am much indebted.

" Jeremiah Smith, 34 years old; pulſe beating 96 ſtrokes in a minute, took 30 drops of the lettuce laudanum, (A. experiment 7.)

In min.	2	5	10	15	20	25	30	35	40	45	55	60	70	80
Pulſe beat	96	96	94	95	98	98	100	101	100	101	101	103	102	102

His face was now evidently flushed, and his ſkin was warmer. He ſaid that he felt very agreeable. His pulſe ſeemed increaſed in force as well as frequency."

" Upon

"Upon taking 30 drops of the ſame preparation, I felt as if I had ſwallowed a glaſs or two of wine, or a ſmall quantity of opium.

"It was given in the following diſeaſes, viz. heart-burn, chronic rheumatiſm; the pain of which occurred in the night; Diarrhœa; and in a pectoral complaint attended with a periodical cough. It ſeemed to deſtroy the diſagreeable ſenſation of heart-burn, and hindered the occurrence of the pain of rheumatiſm. It checked the frequent ſtools accompanying diarrhœa, and occaſioned the evacuation of much flatus. It allayed the cough attending the pectoral complaint. In all theſe caſes it ſeemed to be preciſely analogous in its operation to the tincture of opium; and like opium it increaſes the frequency and energy of the pulſe."

If any perſon reads the foregoing experiments with attention, he cannot heſitate in allowing the moſt perfect identity to the two ſpecies of opium. The experiments of *Whytt*, of *Alſton*, and of others, ſtrengthen in the higheſt degree the evidence of the fact.

The milky juice from which the opium is prepared, exiſts in the ſtalk and in the leaves of the plant. It is not indiſcriminately depoſited throughout, but is placed in appropriate veſſels running longitudinally in the woody or fibrous part of the ſtalk. The internal or medullary part of the plant is ſoft; and perfectly bland to the taſte, abounding in a tranſparent mucilaginous juice; which has not the ſmalleſt analogy to the above-mentioned one.

The beſt time for collecting the juice, is when the plants are beginning to ſeed. If we take it before this, it has not ſufficiently acquired its medical properties; and if at a later period, the quantity is by no means ſo conſiderable.

It is beſt procured in the manner deſcribed for collecting it from the poppy, viz. by inciſions; with this difference, that in the poppy they are *longitudinal*, but in this muſt be circular. A very moderate depth ſuffices. It exudes free-

ly in milky drops, which may be either immediately collected; or ſuffered to dry on the ſtalk, and then ſcraped off and depoſited in proper veſſels. If we obtain it by preſſure from the plant, and then inſpiſſate; the other juices ſeem to alter it conſiderably: the colouring matter of the vegetable is taken up, and the ſmell of the opium no longer exiſts; at leaſt this was the caſe with 30 grains of an extract procured thus, from 10 drachms of the plant, by Dr. Cooper. It poſſeſſed none of the peculiar ſmell or taſte of opium, and when I put it into a mixture of equal parts of alkohol and water, it readily yielded the green colouring principle, but nothing further. Probably more attention to the ſubject will lead to a method of ſeparating the opium from the other principles united to it. Expoſure to the ſun and air, may poſſibly produce this effect: the ſmell of the juice when firſt extracted by preſſure is ſtrong of opium. The extract above alluded to was inſpiſſated in a ſand bath, the heat of which may have been too conſiderable for it.

Having ſaid thus much upon the juice of the common lettuce, I muſt obſerve that all the ſpecies contain it in a larger or ſmaller proportion. The *lactuca ſylveſtris*, or *viroſa* of Linnæus, contains it moſt abundantly. That from which I obtained my opium, was, I obſerved before, the *lactuca ſativa*; it abounds in juice, and will ſerve the double purpoſe of cultivating for the table as well as for the ſhop.

I cannot avoid contraſting the ſuperior advantages of the opium extracted from the *lettuce*, above that procured from the poppy.

Some judgment may be formed of the labour and expence attendant upon the cultivation of one acre of the poppy, by the account given by Mr. Kerr. He ſays "an acre yields in the Eaſt Indies, 60 lbs. of opium, which, at 9 ſhillings ſterling, (2 dollars) per pound, is £.27 an acre." Now,

at

at a moderate computation, it may be preſumed that *one half* of this ſum is employed in the neceſſary expences of ploughing, manuring, ſowing, watering, and collecting, &c. &c. Say then that £.13. 10, are clear gain, (which muſt be allowed to be a large proportion.) Now the *poppy* cannot be employed as an article of diet; whereas the *lettuce*, which grows here in the moſt luxuriant manner, will amply repay the labour and expence (which at moſt is trifling) attending its cultivation, by the ſale of the ſupernumerary plants taken up at an early period for diet, long before the developement of the opium principle. Here then the very labour employed has the double advantage of thinning the plants, thereby rendering the remainder more perfect; whilſt it collects for the market ſuch as have arrived to ſufficient maturity for the table.

The ſale of theſe ſupernumerary plants would, I conceive, *at leaſt* repay the labour, &c. attending their cultivation: and if the reſt yielded per acre *only* 60 lbs. of opium, double the profit would ariſe from its cultivation, above that of the poppy. The great abundance of the juice however, and the luxuriance of the plant, render it highly probable, that *double* that quantity, *if not more*, might be procured from the acre of ground.

The price of this valuable article of the Materia Medica, leads me to hope that farmers and others will attend to the cultivation of the lettuce, in order to obviate one ſource of the annual expenditure of money from the United States; and as Dr. *Crumpe* obſerves in his valuable treatiſe upon opium, "If any overplus remained after our own demands, a ready market would be found for it in the Eaſt Indies, where its conſumption is very conſiderable, and price generally high."

The medical virtues of opium would appear from the experiments of authors, to reſide more particularly in the *extractive* principle. If this be certainly the caſe, the *opium* of

of the *lettuce*, would prove far more valuable to the Materia Medica, than the *common* opium: for by the comparative experiments 3d and 4th, *ten* grains of *extractive* matter were taken up from one *ſcruple* of the *lettuce* opium; whilſt only nine grains of the common opium were taken up from the ſame quantity. This in a pound weight, will give a very decided advantage of *ſix* drachms, *one* ſcruple, *four* grains, to the *lettuce* opium, above the common; for in one lb. of the lettuce opium, *one half*, or 8 oz. are extractive matter, whilſt of the *common* opium only 7 oz. 1 ſc. 1 dr. 16 grs. are extract.

Common Opium.

If grs. 20 : 9 :: grs. 7680. the No. in 1 lb.

9

20 | 69120

6 | 3456

8 | 57.36

oz. 7. 1. 1. 16.

As I conceive the foregoing facts may prove ſerviceable to my fellow citizens, I have taken the liberty of drawing them up in the form of a paper, addreſſed to your reſpectable Body, as the ſureſt mode of obtaining their promulgation.

I have the honor to be,

With the greateſt reſpect,

Your obedient humble ſervant,

JOHN REDMAN COXE.